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(54) **Controlled feed power drill**

(57) A controlled feed power drill has both a manual feed mechanism and a power feed mechanism. Either one of these mechanisms can be used to feed the drill chuck 1. The power feed mechanism is by means of an air motor 10, and both manual and power feed mechanisms are connected to the drill chuck *via* a mechanical positive feed engagement e.g. a rack 4 and pinion. A hand lever rotates an arm to rotate the pinion via a reduction gear. The motor 10 drives a worm 16 to rotate a worm wheel coupled to the arm by a disconnectible pin-and-slot.

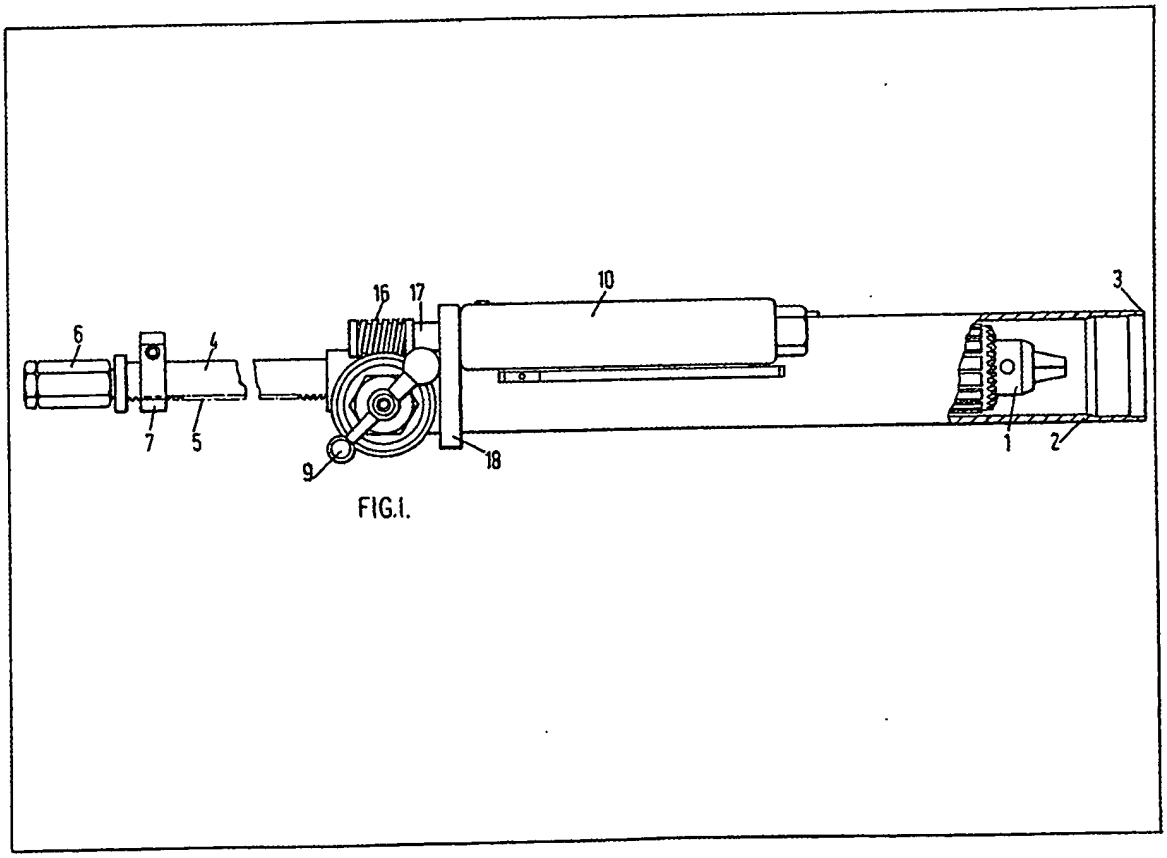

FIG.1.

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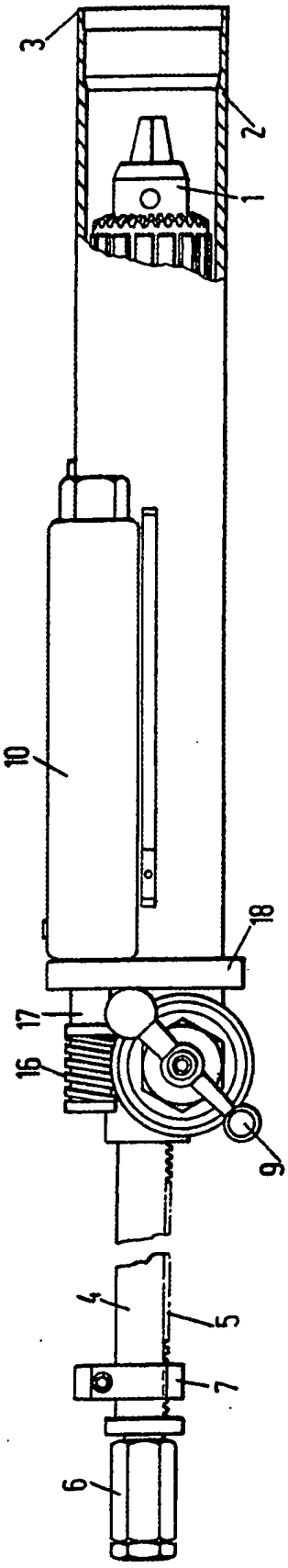

FIG.1.

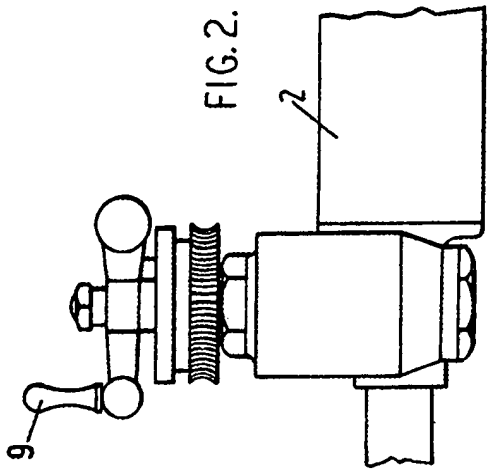

FIG.2.

SPECIFICATION

Controlled feed power drill

This invention relates to a controlled feed power drill.

Many forms of controlled feed drills are known. In some of these, compressed air provides a force for feeding a drill against the resistance of the material being drilled. In such drills, variation in the supplied air pressure affects the rate of feed, and, in addition, when a composite piece of material of differing hardnesses is being drilled, the drill will move at different speeds through the different materials.

Power drills with a manual feed operating through a positive connection are also known. In such tools, the drill chuck may be rotated by an air motor, and fed by means of manual rotation of a pinion which meshes with a rack attached to the drill chuck. This is obviously laborious, but it is necessary, particularly in the case of drills with jig noses as used in the aircraft industry, for the chuck to be rapidly fed up to the workpiece surface, before being more slowly fed as it is actually cutting a hole.

According to the present invention, there is provided a controlled feed power drill having a casing, a chuck driven by a first air motor and mounted for movement relative to the casing, a mechanical positive feed engagement between a component movable with the chuck and a component mounted on the casing, means for manually driving the component mounted on the casing, and a second air motor for powered driving of the component mounted on the casing, said manual means and the air motor being arranged so that either one of the other of them can be used to drive the component mounted on the casing to feed the drill.

Preferably, the positive feed connection is between a rack attached to the drill chuck and a pinion mounted on the casing. The pinion may be connected to a hand wheel which can be directly manually rotated to feed the drill, and the hand wheel may have a worm wheel journalled on its shaft and selectively engageable with the hand wheel, the worm wheel engaging a worm gear fitted on the output shaft of the second air motor. The hand wheel can be axially movable out of engagement with the worm wheel to disengage the second air motor from the feed mechanism, whilst retaining connection between the hand wheel and the pinion.

In use, the drill can therefore be manually wound down until the tip of the drill bit is in contact with the workpiece, and the second air motor can then be started to feed the drill at a controlled rate through the workpiece. The use of a geared connection between the feed motor and the drill means that the drill will be fed at a constant speed independent of the hardness of the material through which the drill is cutting. Such a system is particularly suitable for drilling very deep holes, where the resistance to forward motion of the drill increases as the length of the drill inside the workpiece increases.

The air motor can be fitted with a throttle to provide a fine control over the rate of feed of the drill. Since the air motor drives the feed mechanism through several stages of gearing, any variations in the air pressure will have only a negligible effect on the actual rate of feed of the drill.

The second air motor can be of a standard type, modified to have a trigger which can be locked on, and it can conveniently be arranged parallel with the drill chuck so as to provide a handle by which the drill can be carried.

The drill should be fitted with a device to stop feeding of the drill when a predetermined depth of hole has been reached.

The second air motor can be switched off once the required depth has been reached, and the manual feed mechanism brought into operation to retract the drill from the hole.

The invention will now be further described, by way of example, with reference to the accompanying drawing, in which:

Figure 1 is a side view of a drill according to the invention; and

Figure 2 is a plan view of part of the drill showing the feed mechanism.

A drill chuck 1 is mounted inside a tubular housing 2. An air motor is provided to rotate the chuck 1, but in the drawing this air motor is concealed within the tube 2 and cannot be seen. The front end 3 of the tube 2 can have a jig nose, i.e. a fitting by means of which the tube 2 can be located and attached to a jig so that a hole drilled by the drill will be precisely located relative to the jig, with the tube 2 being held stationary while the hole is being drilled.

A feed control rod 4 extends from the opposite end of the tube 2. The control rod 4 is connected to the chuck 1, so that as the chuck is fed towards the workpiece, the rod 4 moves into the tube 2. The rod 4 has a rack formation 5 along one face. The rod 4 is hollow and has an air connection 6 at its end through which compressed air can be fed to the motor for rotating the chuck 1. The rod 4 also carries an adjustable depth stop 7 which controls the distance the chuck 1 can move towards the workpiece.

In order to feed the chuck towards the workpiece, a feed mechanism generally indicated at 8 is provided. This mechanism cooperates with the rack 5, and includes a pinion (not shown) which meshes with the rack teeth and which can be rotated either by means of handle 9 or by means of air motor 10.

The handle 9 is mounted at the and of an arm 11. The arm 11 is fixed to a shaft 12 which is connected, through an epicyclic reduction gear, to the pinion (not shown). Rotation of the handle 9 therefore rotates the pinion and moves the rod 4 and the chuck 1 towards the workpiece.

The arm 11 carries a pin 13 which connects the arm with a worm wheel 14. The end face 15 of the worm wheel 14 has a series of holes in it each of which can receive the pin 13. Therefore,

for purely manual operation of the feed mechanism, the handle 9 with its arm 11 is pulled away from the body of the tool to disengage the pin 13 from a hole in face 15, and for powered operation, the handle 9 and arm 11 are pushed back so that the pin engages in one of the holes in the face 15 of the worm wheel 14, so that the worm wheel 14 rotates with the shaft 12.

The worm wheel 14 meshes with a worm gear 16 on the output shaft 17 of motor 10. When the motor 10 is operating and the pin 13 is engaged in one of the holes in the worm wheel 14, the shaft 12 will be driven at a constant rate by the motor.

An adjustable throttle valve will control the speed of the motor within certain limits. To make a more drastic change in the rate of feed, a motor of different output shaft speed could be substituted for the motor 10.

In use, the handle 9 and arm 11 will be pulled out initially so that the chuck 1 can be wound down until the drill bit is in contact with the workpiece. The handle 9 and arm 11 will then be pushed in so that the power drive takes over to feed the drill at a constant rate through the workpiece.

The motor 10 is attached to the tube 2 of the drill by a bracket 18. The motor will be spaced from the tube body 2, so that it can form a handle for the drill. It will be noted that the body of the motor 10 is arranged close to the centre of gravity of the tool, so that the tool is balanced when being lifted by the body of the motor 10.

A proximity switch will be provided to switch off both air motors at completion of a cutting operation; this will normally be when a predetermined depth of hole has been reached.

Although a rack and pinion feed is described, other forms of mechanical positive feed engagement could be used, for example a threaded shaft passing through an axially stationary but rotatable nut.

CLAIMS

1. A controlled feed power drill having a casing, a chuck driven by a first air motor and mounted for movement relative to the casing, a mechanical positive feed engagement between a component movable with the chuck and a component mounted on the casing, means for manually driving the component mounted on the casing, and a second air motor for powered driving of the component mounted on the casing, said manual means and the air motor being arranged so that either one or the other of them can be used to drive the component mounted on the casing to feed the drill.

2. A drill as claimed in claim 1, wherein the positive feed connection is between a rack attached to the drill chuck and a pinion mounted on the casing.

3. A drill as claimed in claim 2, wherein the pinion is connected to a hand wheel which can be engaged with or disengaged from a worm wheel engaged by a worm gear fitted on the output shaft of the second air motor.

4. A drill as claimed in claim 3, wherein the hand wheel is movable into and out of connection with the worm wheel.

5. A drill as claimed in any preceding claim, wherein the air motor is fitted with a throttle to provide a fine control over the rate of feed of the drill.

6. A controlled feed power drill substantially as herein described with reference to and as shown in the accompanying drawings.

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